

BALL SOCKET

The invention relates to a ball socket for receiving a ball and to a rotatably mounted connecting arrangement for connecting two components in a vehicle.

5 Rotatably mounted connecting arrangements for connecting vehicle components or ball joints can perform various functions in motor vehicles. One component that is to be connected has a ball at one end, while the other component that is to be connected has a ball socket or ball cage at one
10 end. To provide the connection between the two components, the ball is received in the ball socket or ball cage. This arrangement allows the two components to pivot relative to one another about a common pivot point which is arranged in the ball joint.

15 Known single-piece ball sockets made from soft material do not have the rigidity required for certain applications. Single-piece ball sockets made from hard and brittle plastic do have the required rigidity but are subject to the drawback that
20 they can break when they are bent open during fitting to the ball. Consequently, the strip thickness and the wrapping of the ball socket around the ball are subject to restrictions. The fact that forced deformation is to be possible during insertion of the ball into the ball socket is detrimental to
25 the shape of the ball sockets.

German laid-open specification DE 42 11 897 A1 describes a ball joint for parts of a steering mechanism or wheel suspension of motor vehicles. This ball joint has a radially
30 resilient bearing socket which is made from plastic and accommodates a ball head of a link pin. The outer circumference of the bearing socket is mounted in a recess in

a joint housing, and a cylindrical part of its peripheral surfaces bears against a cylindrical wall portion. The bearing socket surrounds the ball head by means of a securing member which is inserted into the housing recess and secures
5 the bearing socket prestressed therein. The bearing socket has a slot passing through it transversely to the circumferential direction. Insertion of the ball into the bearing socket is facilitated by this design.

10 It is an object of the invention to improve the configuration of a ball socket.

For this purpose, the invention proposes a ball socket having the features of patent claim 1 and a rotatably mounted
15 connecting arrangement having the features of patent claim 11.

The ball socket according to the invention for receiving a ball has at least one region which consists of an elastically deformable material or has an elastically deformable geometry.
20 The result of this is that the ball socket does not break when it is bent open as a result of the ball being introduced and then returns to its original position. This allows simple assembly of a ball joint comprising a ball socket and a ball. Moreover, the ball is securely received in the ball socket
25 according to the invention.

The ball socket is preferably designed in such a way that it covers a ball portion, which is delimited by at least one circle, of the ball. It is also possible for the ball socket
30 to be designed in such a way that it covers a ball portion, which is delimited by two circles arranged parallel to one another and is designed as a ball layer, of the ball. It is in each case provided that the ball socket engages around an equator of the ball. The ball portion may be designed in such
35 a way that it surrounds the ball apart from an opening at one

pole of the ball. The ball layer is in this case formed in such a way that it surrounds the ball apart from two openings at opposite poles of the ball. The ball socket, which is designed as a ball layer, covers the ball in a region up to
5 several degrees above the equator and also in a region up to several degrees below the equator of the ball.

It may be provided that the ball socket has at least one gap. In this case, the at least one gap is oriented perpendicular
10 to the at least one circle, in particular to the at least two circles, of the ball socket designed as a ball layer. An opening of this type arranged at the ball socket allows widening of the ball socket during fitting of the ball.

15 In a further advantageous configuration of the invention, the elastically deformable region is designed as an elongate portion which is arranged diagonally with respect to the gap. This makes it easy for the ball socket to widen during assembly. On account of the fact that the gap and the
20 elastically deformable region are arranged diagonally with respect to one another, maximum opening of the ball socket is possible in a direction perpendicular to the gap.

Alternatively, the ball socket may have two gaps which are
25 arranged diagonally with respect to one another along a circumference of the ball. On account of this configuration of the ball socket, there are two options for an advantageous arrangement of the elastically deformable region.

30 The elastically deformable region may be arranged between a gap. If the ball socket is designed in the form of a ball layer with two gaps arranged diagonally with respect to one another, this configuration of the invention in functional terms corresponds to the variant of forming the ball layer
35 with a gap and an elastically deformable region arranged

diagonally with respect to the gap as the elongate portion. However, if the ball socket is formed as a ball portion which is delimited by one circle, this ball portion may have a gap at which the elastically deformable region is arranged.

5 Therefore, a single-piece ball socket having two components which can move relative to one another by way of the elastically deformable region is in each case provided.

10 If the ball socket has two gaps, it is also recommended that the elastically deformable region be arranged between a first point and a second point of the circle which delimits the ball socket. This advantageously also provides a cohesive, single-piece ball socket which has two components which are connected such that they can move relative to one another by means of
15 the elastically deformable region and form a ball socket.

The two components of the ball socket which are connected to one another by way of the elastically deformable region may consist of hard and brittle plastic. The elastically
20 deformable region can be of thin-walled design. This means that the elastically deformable region has a lower wall thickness than the two components. On account of this configuration, the ball socket can easily be deformed along the elastically deformable region in such a way that the other
25 two components forming the ball socket can move in a simple way relative to one another and, moreover, securely hold the ball within the ball socket.

In the rotatably mounted connecting arrangement according to
30 the invention for connecting two parts in a vehicle, the first part has a ball as connecting element and the second part has the ball socket according to the invention as connecting element for receiving the ball. A connecting arrangement of this type or a ball joint of this type is versatile in use in
35 the motor vehicle. Assembly can be executed without problems

on account of the advantageous configuration of the connecting arrangement.

Further advantages and configurations of the invention will
5 emerge from the description and the appended drawing.

It will be understood that the features referred to above and those which are yet to be explained below can be used not only in the combination indicated in each instance but also in
10 other combinations or also as stand-alone measures, without departing from the scope of the present invention.

The invention is diagrammatically depicted in the drawing on the basis of an exemplary embodiment and is described
15 extensively below with reference to the drawing, in which:

Fig. 1 shows a first configuration of the ball socket according to the invention.

20 Fig. 2 shows a sectional view of the ball socket according to the invention in a first configuration.

Figs 3 to 5 show the insertion of a ball into a ball socket in accordance with the first configuration of the invention.

25 Fig. 6 shows a ball socket in a second configuration of the invention.

Fig. 7 shows a sectional view through the ball socket in the
30 second configuration of the invention.

Figs. 8 and 9 show the insertion of a ball into a ball socket in accordance with the second configuration.

The figures are described jointly and in an interrelated way. Identical reference designations denote identical components.

5 The first embodiment of the ball socket 1 according to the invention, which is illustrated from various perspectives and in different states in Figs. 1 to 5, has the following components: two part-sockets 2a, 2b, which are connected to one another via an elastically deformable region 6 in such a way that the entire ball socket 1 is of single-piece, cohesive
10 design. Moreover, the ball socket 1 has a first gap 4a and a second gap 4b. The first gap 4a separates the two part-sockets 2a, 2b from one another. Along the second gap 4b is arranged the elastically deformable region 6, by which the two part-sockets 2a, 2b are connected to one another so that they
15 jointly and in single-piece form produce the first embodiment of the ball socket 1 according to the invention.

Fig. 2 shows the ball socket 1 from Fig. 1 in a sectional view from a perspective corresponding to the two arrows indicated
20 in Fig. 1. This perspective reveals the part-socket 2b. The section passes through the two gaps 4a (left-hand side) and 4b (right-hand side) arranged diagonally with respect to one another. The elastically deformable region 6 is arranged along the gap 4b illustrated on the right-hand side,
25 diagonally with respect to the gap 4a illustrated on the left-hand side. Fig. 2 also indicates an equator line illustrating an equator 8 of the ball 10. The part-socket 2b, relative to the equator 8, extends from a first angle region above the equator 8 to a lower angle region below the equator 8. The
30 same applies to the part-socket 2a. This ensures that a ball which is to be received by the ball socket 1 is substantially covered or encircled so that the ball is securely held in the ball socket.

Fig. 3 shows a ball 10 of this type before it is introduced into the ball socket 1 during assembly. The ball socket 1, and in particular the elastically deformable region 6, are in a load-free state in this figure.

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As shown in Fig. 4, the ball 10 has been forced by pressure sufficient to overcome a mechanical resistance of the elastically deformable region 6 to penetrate partway into the receiving regions, delimited by the part-sockets 2a (right-hand side) and 2b (left-hand side), of the ball socket 1. This stretches the elastically deformable region 6 arranged along the gap 4b. This can be recognized from the fact that the distance between the two part-sockets 2a, 2b in Fig. 4 is greater than the distance in Fig. 3. On account of the elastically deformable region which connects the two part-sockets 2a, 2b to one another, these two part-sockets 2a, 2b can be moved relative to one another when the ball 10 is being inserted into the ball socket 1.

For this purpose, Fig. 5 shows how the ball 10 has been completely received in the ball socket 1. The ball socket 10 is covered within the region covered by the two part-sockets 2a, 2b. Since the elastically deformable region, after insertion of the ball 10 into the ball socket is complete, springs back into its original shape, the ball 10 is securely received in the ball socket 1.

The ball socket 1 covers or receives the ball 10 in the region of what is referred to as a ball layer. This ball layer is delimited at the top by a circle 9a indicated by a circle line and at the bottom by a circle 9b indicated by a circle line. These two circles 9a, 9b are arranged parallel to the equator 8 indicated by the equator line.

Figs. 6 to 9 show a ball socket 11 in a further configuration of the invention. This ball socket 11 is formed by two part-sockets 12a, 12b, which are connected to one another by means of an elastically deformable region 16. The two part-sockets 12a, 12b are separated by two gaps 14, which are arranged or oriented perpendicular to the elastically deformable region 16. The elastically deformable region is arranged between two portions 30, 31 of a circle 29 which is interrupted by the gaps 14 and delimits the two part-sockets 12a, 12b.

Fig. 7 shows the ball socket 11 in accordance with the sectional view indicated by the two arrows from Fig. 6. This illustration clearly reveals the single-piece design of the ball socket 11, i.e. the unit made up of the left-hand part-socket 12a, the elastically deformable region 16 and the right-hand part-socket 12b. The figure also shows the gap 14. As in the exemplary embodiment of the first ball socket 1 illustrated in Figs. 1 to 5, the part-sockets 12a, 12b and therefore the entire ball socket 11 extend from a region above an equator 18 indicated by an equator line to a region below the equator 18 indicated by the equator line. Consequently, the ball 11 received by the ball socket 11 can be securely held in place.

Fig. 8 shows, in a corresponding way to Fig. 4, how a ball 20 is inserted into the ball socket 11. On account of a force with which the ball 20 is pressed downward, the two part-sockets 12a, 12b are folded open in scissor or clamp fashion, with the elastically deformable region 16 stretching. A relative movement of the part-socket 12a with respect to the part-socket 12b of this type when the ball 20 is being received is made possible by the nature of the elastically deformable region 16. As a result, the gap 14 is widened from the bottom upward.

Fig. 9 shows the ball 20 which has been received in a ball socket 11. After the ball 20 has been inserted, the elastically deformable region 16 snaps or springs back into a starting position. This restores the original distance
5 between the two part-shells 12a, 12b. The gap 14 also reverts to its original width and the ball 20 is covered over a ball layer by the ball socket 11. This ball layer is delimited at the top by a circle 19a indicated by a circle line and at the bottom by a circle 19b indicated by a circle line, both of
10 which are arranged parallel to the equator 18.

The ball sockets 1, 11 according to the invention can have a greater wall thickness than known ball sockets and permit the ball 10, 20 to be engaged around to a greater extent. This
15 results in a wider range of applications with hard and brittle plastics. Furthermore, the wear resistance under very high loads is increased. Axial and radial prestressing conditions are significantly improved compared to the cited prior art (DE 42 11 897 A1), so that, for example, there is no need to
20 provide any protection against twisting. The invention allows an in relative terms thicker, more wear-resistant ball socket 1, 11 to be provided under the same installation conditions.

The design and assembly problems which generally occur with
25 known devices are eliminated in accordance with the first embodiment of the ball socket 1 by the elastically deformable region 6 arranged along the gap 4b. Contrary to other design solutions, only tensile forces occur along the elastically deformable region, which may be designed, for example, as a
30 thin-walled gap 4b. A further advantage is that a ball geometry which is provided by the region covered by the ball socket 1 is not affected by forced deformation.

In the second embodiment of the invention, embodied by the
35 ball socket 11, design and assembly problems which occur are

eliminated by the elastically deformable region 16 which is arranged in a lower region of the ball socket 11. The elastically deformable region 16 of the ball socket 11 may in this case, for example, be designed in the form of a web and
5 surround a pole of the ball 20 below the equator 18. In this case too, it is provided that the thin-walled, elastically deformable region 16 of web-like design is easily deformable compared to the remainder of the ball socket, in particular the two part-sockets 12a, 12b.